

Introduction

As reported elsewhere (see Liller, 1993 for the most recent summary and for other references), there now exists overwhelming statistical evidence that on Rapa Nui, as many as 15 or 20 *ahu* were constructed with their orientations or locations—or both—carefully pre-determined with an astronomical intent in the minds of the designers. One of the most outstanding examples is Ahu Huri A Urenga, the modest single-*moai* *ahu* on the outskirts of Hanga Roa close to the road from the airport to Anakena. (This *moai* is perhaps best known for having four hands.)

Elsewhere in Polynesia, much work still remains to be done, but I can report that on those other islands where I have made measurements, I have been unable to find an abundance of astronomically oriented or located *marae* or *heiau* at all comparable to what is found on Rapa Nui. So far, my wife and I have visited some twenty other islands and measured over a hundred structures. The most promising found so far are the remarkable standing stones of Aitutaki in the Cook Islands, and the massive trilithon, Ha'amonga-'a-Maui, on Tongatapu, the principal island of the Kingdom of Tonga. But then special note should be made of the "Vatican" of Ancient Polynesia, Marae Tapu-tapu-atea on Ra'iatea: neither its orientation nor location seem to have astronomical significance.

Other islands such as those in the Australs show promise however. According to Edmundo Edwards who has recently carried out extensive archaeological investigations on Ra'ivavae and Tubuai, two islands which straddle the Tropic of Capricorn south of Tahiti, there is evidence that some of the more important *marae*—perhaps fifteen per cent—were intentionally aligned north-south, east-west, and several solstitially. He cautions, however, that his measurements were made with a magnetic compass, and magnetic anomalies can occur on these rocky volcanic islands, just as they do on Rapa Nui (Edwards 1993). The same can be said for Verin's (1968) conclusion that, on the neighboring island of Rurutu, four out of six *marae* were solstitially oriented.

It should also be noted that many years ago, Buck wrote, "Mangareva is unique in Polynesia in having studied the northern and southern limits of the course of the sun"; and it was known on Mangareva (which also lies near the Tropic of Capricorn) that "the winter solstice was reached when the shadow of Mt. Duff arrived at a certain stone which it did not pass." (Buck 1938). But of course, few ancient monuments remain on this well-missionized island. I can report, however, that the one structure that I was able to inspect and measure on Mangareva, named interestingly enough "La Tour du Soleil," showed no special orientation (it was a round tower) nor significant location. But being a mountainous island, magnetic anomalies may well have affected my compass readings.

The Hawaiian Islands now need concentrated attention—and soon. On our three visits to those well-populated islands, we were disheartened at the number of ancient *heiau* we went to find, only to discover that they had been totally destroyed

by newly constructed hotels, condominiums and shopping malls. (On Maui we were threatened with legal action if we so much as crossed a golf course under construction just to inspect and measure a *heiau*). If measurements of orientations are not made soon, there will be little left to measure—and the same can be said of many other islands in the South Pacific increasingly trampled by tourists.

Interpretations

Given that some *marae*, *heiau* and *ahu* are oriented and located astronomically, we would like to go further than just cataloging these structures. Putting it more bluntly, while we know now that seven or eight coastal *ahu* on Rapa Nui are oriented with their long axes pointing closely in the north-south direction, so what? And we know that the *moai* of another five or six inland *ahu* were facing directly towards the point on the horizon where the solstice sun rose or set. Again, so what?

With little ethnological information to guide us, we must try to deduce for ourselves the reasons. Here follow some likely possibilities.

Ritual considerations. As in all ancient civilizations, the cosmos was viewed with special reverence. The seemingly mystical apparent motions of the sun, moon, and planets against the starry background (the sun's position had to be deduced, of course) was a source of immense wonder, and the ancient priests interpreted these movements as the work of powerful gods. It was an easy matter for the priests and other learned natives to see that certain directions in the sky were fundamental—the cardinal directions of north, south, east and west; and the directions (four of them) to the rising and setting points of the solstitial sun.

We must conclude, therefore, that certain repetitive celestial events such as the annual return of the sun to a given solstice or equinox (or even the daily sunrise) must have given rise to certain religious rites observed yearly (or daily). Thus, a temple oriented with the rising solstitial or equinoctial sun could very well have been built that way with nothing more than a ritual purpose in mind. And of course, the word ritual usually implies a repetitive event such as these solar happenings.

Navigational considerations. But the ancient Polynesians had more mundane and practical concerns, like in which direction to steer a boat. The colossal navigational feats of the ancient Polynesians are well known, and fishing was an important and life-sustaining industry.

Recording the cardinal directions with stone monuments would have made easier the task of setting off in a desired direction. By the 15th or 16th century the Rapa Nui may have been despaired of making long ocean voyages owing to a lack of wood, but still that increasingly remote possibility may have persisted in the minds of many, especially the coastal dwellers. It would be interesting to know the dates of construction of the seven or eight coastal *ahu* aligned with the cardinal directions. Were they all built earlier than the disap-

pearance of island trees, whenever that was?

Furthermore, the isolation of Rapa Nui presented special problems to would-be navigators that didn't exist in island groups like the Hawaiian Islands. There majestic mountains on distant but visible islands served as excellent natural pointers to show navigators the directions to head towards more distant destinations. There would have been less practical need to build pointing devices. The same is true of the Society Islands, the Samoa group, and the Kingdom of Tonga: few of the islands are so remote that another island cannot be seen and used as a direction indicator.

On the other hand, islands like Aitutaki in the Cooks, and Ra'ivavae and Tubuai in the Australs lie several hundred kilometers from the next nearest island; having carefully oriented temples or constructing long lines of standing stones would have been almost vital to sailors heading off to nearby but unseen islands.

The conclusion, then, is that structures pointing to the cardinal directions of north, south, east, and west should be found primarily on isolated islands, and the structures should, for the most part, be near the coasts where they can be seen from the sea. That indeed seems to be what occurs, not only on Rapa Nui but on the other isolated islands such as Aitutaki and Ra'ivavae.

Agricultural considerations. In order to reap the most bountiful harvests on lands where the seasonal changes are well marked, the plantings of annual crops have to be made at certain times of years. Generally speaking, this will be true on sub-tropical islands, especially those located well south of 23.5 degrees south latitude (Tropic of Capricorn) or north of 23.5 degrees north latitude (Tropic of Cancer). New Zealand and the nearby Chatham Islands certainly fulfill this condition, as do both Rapa Nui and Rapa Iti at 27 degrees south latitude. The only other subtropical Polynesian islands are those in the Pitcairn group, the little studied (and perhaps never occupied) Kermadec Islands, and the extreme northern islands of the Hawaiian group.

Island dwellers who grew crops generally lived farther inland than the sea-going fishermen and sailors. They would have been most interested in when the sun reached the winter solstice since planting must be started sometime afterwards, perhaps as late as the spring equinox.

On Rapa Nui, the preferred orientation of the inland *ahu* is, in fact, the direction towards the rising winter solstice. The second most favored direction is toward the equinoctial rising point (due east). And on this isolated sub-tropical island, there would seem to be solid, practical, agricultural reasons for these orientations.

Among the Polynesians, seasonal concerns must have been greatest with the *maori* who lived on the most southerly islands of Polynesia, and my wife and I hope to visit New Zealand and the Chathams soon to see if solstice markers are present. However, the point mentioned earlier, namely that there is little need for direction indicators if other islands are nearby, may have reduced or eliminated the need for solstice indicators in New Zealand and the Chathams. At the next Rapa Nui conference, I hope to be able to report back to you on what we found.

Conclusions

It seems highly likely that on Rapa Nui, the unusually frequent occurrence of coastal *ahu* oriented with the cardinal points of the compass grew out of the natives desire to mark these directions for navigational reasons. Inland *ahu* show a definite tendency to be oriented with the winter solstice, and this would be expected since the crop-growers would want to know when the days were again beginning to lengthen. To what extent ritual reasons were involved in the building of astronomically oriented temples is difficult to know, but there would be compelling reasons to construct them.

On the other Polynesian islands so far investigated, isolated islands seem to have larger numbers of astronomically-oriented structures than those with other islands in sight, very possibly because these other islands served as excellent natural pointers no human effort was needed to build pointers.

Finally, so what? Knowing the reasons why temples and monuments were intentionally oriented astronomically, we can conclude that the ancient Polynesians, especially the Rapa Nui, possessed a sophistication level sufficient to at least recognize the presence of cyclic phenomena in the skies. Adding to this the incredible navigational skills that the Polynesians repeatedly demonstrated, we see that the level of sophistication was impressively high. During the 8th century AD a highly unusual series of solar eclipses occurred on the island of Rapa Nui—5 total or near-total in ten years (see Liller 1993)—and quite possibly, the inhabitants soon deduced the cause of eclipses and perhaps even came close to being able to predict future eclipses. It is quite tempting to link these considerable skills with other signs of unusual mental activity, the *rongorongo* script for example. Barthel (1990), Rjabdhikov (1993) and others have already made the suggestions—or claims—that at least some of the *rongorongo* writings have a strong astronomical flavor.

References

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